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"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड़ नये के तरफ"
Jawaharlal Nehru
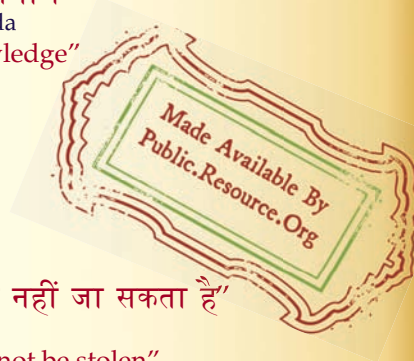"Step Out From the Old to the New"

IS 8378 (1987): Vocabulary for basic and general terms in dimensional metrology [PGD 25: Engineering Metrology]

"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
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"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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Indian Standard

VOCABULARY FOR
BASIC AND GENERAL TERMS IN DIMENSIONAL METROLOGY

(First Revision)

1. Scope — Covers the basic and general terms relating to dimensional measurements and instruments in metrology.

2. Quantities and Units

2.1 *Quantity* — An attribute of a phenomenon, body or substance which may be distinguished qualitatively and determined quantitatively.

> Note 1 — The term 'quantity' may refer to a quantity in a general sense [*see* example (a)] or to a specific quantity [*see* example (b)].

> Note 2 — Quantities which are mutually comparable may be grouped together into categories of quantities, for example, thickness, circumference, wavelength.

Examples:

a) Quantities in general sense, that is, length, angle; and

b) Specific quantities, that is, length of a particular rod, half-angle of a taper.

2.2 *Derived Quantity* — A quantity defined as function of base quantity.

2.3 *Dimensionless Quantity* — A quantity in the expression of which the exponents of the base quantities, in a given system, are zero.

Example : Linear strain.

2.4 *Unit (of Measurement)* — A specific quantity, adopted by convention, used to express quantitatively, quantities which have the same dimension.

2.5 *Symbol of a Unit (of Measurement)* — A conventional sign designating a unit of measurement.

Example : m is the symbol for metre.

2.6 *System of Units (of Measurement)* — A set of units established for a given system of quantities.

> Note — A system of units comprises a set of chosen base units, together with dervied units determined by their defining equations and proportionality factors.

Example:

a) International system of units — SI, and

b) CGS system of units.

2.7 *Coherent System of Units (of Measurement)* — A system of units composed of a set of base units and coherent derived units.

Example: Metre.

2.8 *International System of Units, SI* — The coherent system of units adopted and recommended by the General Conference on Weights and Measures.

> Note — For the length measurement, SI is based at present on the base unit as, the metre, unit of length.

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2.9 *Base Unit (of Measurement)* — A unit of measurement of a base quantity in a given system of quantities.

2.10 *Multiple of a Unit (of Measurement)* — A large unit of measurement which is formed from a given unit according to scaling conventions.

Example: One of the decimal multiples of the metre is the kilometre.

2.11 *Sub-Multiple of a Unit (of Measurement)* — A smaller unit of measurement which is formed from a given unit according to scaling conventions.

Example: One of the decimal sub-multiples of the metre is the millimetre.

2.12 *Value (of a Quantity)* — The expression of a quantity in terms of a number and an appropriate unit of measurement.

Example: 5˙3 m.

2.13 *True Value (of a Quantity)* — The value which characterizes a quantity perfectly defined in the conditions which exist when that quantity is considered.

Note — The true value of a quantity is an ideal concept and, in general, cannot be known exactly. Indeed, quantum effects may preclude the existence of a unique true value.

2.14 *Conventional True Value (of a Quantity)* — A value of a quantity which, for a given purpose, may be substituted.for the true value.

Note — A conventional true value is, in general, regarded as sufficiently close to the true value for the difference to be insignificant for the given purpose.

Example: Within an organization, the value assigned to a reference standard may be taken as the conventional true value of the quantity realized by the standard.

2.15 *Numerical Value (of a Quantity)* — The number in the value of a quantity.

Example: 5˙3.

2.16 *Reference-Value Scale (of a Quantity or Property)* — For a given quantity or property, a series of values determined in a defined manner and adopted by conversion.

Example: The Mohs hardness scale based on hardness of a series of specified minerals.

3. Measurements

3.1 *Measurement* — The set of operations having the object of determining the value of a quantity.

3.2 *Metrology* — The field of knowledge concerned with measurement.

Note — Metrology includes all dimensional aspects both theoretical and practical with reference to measurements, irrespective of their level of accuracy.

3.3 *Static Measurement* — The measurement of a quantity whose value can be considered constant for the duration of the measurement.

Note — The qualifier 'static' applies to the measurand and not to the method of measurement.

3.4 *Principle of Measurement* — The specific basis of a method of measurement.

Examples:

   a) The Abbi's effect of alignment applied to the measurement of length, and

   b) Taylor's principle of gauging.

3.5 *Method of Measurement* — The set of theoretical and practical operations, in general terms, involved in the performance of measurements according to a given principle.

3.6 *Measurement Procedure* — The set of theoretical and practical operations, in detailed terms, involved in the performance of measurements according to a given method.

3.7 *Measurement Process* — All the information, equipment and operations relevant to a given measurement.

Note — This concept embraces all aspects relating to the performance and quality of the measurement; it includes for example, the principle, method, procedure, values of the influence quantities and the measurement standards.

3.8 *Measurand* — A quantity subjected to measurement.

Note — As appropriate, this may be the measured quantity or the quantity to be measured.

3.9 *Influence Quantity* — A quantity which is not the subject of the measurement but which influences the value of the measurand or the indication of the measuring instrument.

Example: Ambient temperature; frequency of an alternating measured voltage.

3.10 *Transformed Value* (*of a Measurand*) — A value of a quantity which represents the measurand and which is functionally related to it.

Note — The transformed value may be internal to a measuring system or may be provided as output from the system.

Examples:

   a) The value represented by a binary train within a digital electronic system or computer, and

   b) Value of pressure transformed in terms of dimensional value on air gauge.

3.11 *Measurement Signal* — A representation of a measurand within a measuring system.

Note — The input signal to a measuring system may be called the stimulus; the output signal may be called the response.

3.12 *Direct Method of Measurement* — A method of measurement in which the value of a measurand is attained directly, rather than by measurement of other quantities functionally related to the measurand.

Note — The method of measurement remains direct even if it is necessary to make supplementary measurements to determine the values of influence quantities in order to make corresponding corrections.

Example: Measurement of a length using a graduated rule.

3.13 *Indirect Method of Measurement* — A method of measurement in which the value of a measurand is obtained by measurement of other quantities functionally related to the measurand.

Examples:

   a) Measurement of pitch diameter of thread by three wire method, and

   b) Measurement of tooth thickness of gear by span measurement method.

3.14 *Fundamental Method of Measurement* — A method of measurement in which the value of a measurand is determined by measurement of the appropriate base quantities.

3.15 *Definitive Method of Measurement* — A method of measurement of a quantity in accordance with a definition of the unit of that quantity.

3.16 *Direct Comparison Method of Measurement* — A method of measurement in which the measurand is compared directly with a quantity of the same kind having a known value.

Examples:

   a) Measurement of a length using gauge block and comparator, and

   b) Measurement of a length using graduated rule.

3.17 *Substitution Method of Measurement* — A method of measurement in which the measurand is replaced by a quantity of the same kind, of known value, and chosen so that the effects on the indicating device are the same.

Example: Determination of length by using setting master.

3.18 *Differential Method of Measurement* — A method of measurement in which the measurand is compared with a quantity of the same kind, of known value only slightly different from the value of the measurand, and in which the difference between the two values is measured.

Examples:

a) Measurement of a bore diameter by using dial bore gauge and setting ring, and

b) Measurement of diameter of a piston by means of slip gauge and a comparator.

3.19 *Null Method of Measurement* — A method of measurement in which the value of the measurand is determined by balancing, adjusting one or more quantities, of known values, to which the measurand has a known relationship at balance.

Note — The measurand and the adjusted quantities may be of different kinds.

Example: Measurement of a dimension by means of an air gauge.

4. Measurement Results

4.1 *Result of a Measurement* — The value of a measurand obtained by measurement.

Note 1 — When the term 'result of a measurement' is used, it should be made clear whether it refers to:

a) the indication,

b) the uncorrected result, or

c) the corrected result,

and whether averaging over several observations is involved.

Note 2 — A complete statement of the result of a measurement includes information about the uncertainty of measurement and about the values of appropriate influence quantities.

4.2 *Indication* (*of a Measuring Instrument*) — The value of a measurand provided by a measuring instrument.

Note 1 — The indication is expressed in units of the measurand, regardless of the units marked on the scale. What appears on the scale (sometimes called direct indication, direct reading or scale value) has to be multiplied by the instrument constant to provide the indication.

Note 2 — For a material measure, the indication is its nominal or marked value.

Note 3 — The meaning of the term 'indication' is sometimes extended to cover what is recorded by a recording instrument, or the measurement signed within a measuring system.

4.3 *Uncorrected Result* — The result of a measurement before correction for assumed systematic errors.

Note 1 — If only a single indication is involved, the uncorrected result is identical to the indication.

Note 2 — In English, uncorrected result was formerly referred to as indicated value.

4.4 *Corrected Result* — The result of a measurement obtained after having made corrections to the uncorrected result in order to take account of assumed systematic errors.

4.5 *Accuracy of Measurement* — The exactness of the indicated readings with the actual values of the measured dimension or property.

Note — The use of the term precision for accuracy should be avoided.

4.6 *Repeatability of Measurements* — The closeness of agreement between the results of successive measurements of the same measurand carried out subject to all of the following conditions:

a) the same method of measurement,

b) the same observer,

c) the same measuring instrument,

d) the same location,

e) the same condition of use, and

f) repetition over a short period of time.

Note — Repeatability may be expressed quantitatively in terms of dispersion of the results.

4.7 *Reproducibility of Measurements* — The closeness of agreement between the results of measurements of the same measurand where the individual measurements are carried out changing conditions such as:

    a) method of measurement,

    b) observer,

    c) measuring instruments,

    d) location,

    e) condition of use, and

    f) time.

Note 1 — A valid statement of reproducibility requires specification of the conditions changed.

Note 2 — Reproducibility may be expressed quantitatively in terms of dispersion of the results.

4.8 *Experimental Standard Deviation* — For a series of n measurements of the same measurand, the parameter s characterizing the dispersion of the results is given by the formula:

$$s = \sqrt{\frac{\sum\limits_{i=1}^{n} (x_i - \bar{x})^2}{n-1}}$$

x_i being the result of the ith measurement and $\bar{x}$ being the arithmetic mean of the n results considered.

Note 1 — The experimental standard deviation should not be confused with the population standard deviation σ of a population of size N and of mean m, given by the formula:

$$\sigma = \sqrt{\frac{\sum\limits_{i=1}^{N} (x_i - m)^2}{N}}$$

Note 2 — Considering the series of n measurements as a sample of a population, s is an estimate of the population standard deviation.

Note 3 — The expression $s/\sqrt{N}$ provides an estimate of the standard deviation of the arithmetic mean $\bar{x}$ with respect to the mean m of the overall population. The expression $s/\sqrt{N}$ is called the experimental standard deviation of the mean.

4.9 *Uncertainty of Measurement* — An estimate characterizing the range of values within which the true value of a measurand lies.

Note — Uncertainty of measurement comprises, in general, many components, some of the components may be estimated on the basis of statistical distribution of results of series of measurements and can be characterized by experimental standard deviations. Estimates of other components can only be based on experience or other information.

4.10 *Error of Measurement* — The result of a measurement minus the true (conventional) value of the measurand.

Note 1 — The term relates equally to:

    a) the indication,

    b) the uncorrected result, and

    c) the corrected result.

Note 2 — The known parts of error of measurement may be compensated by applying appropriate corrections, the error of the corrected result can only be characterized by an uncertainty.

Note 3 — 'Absolute error' which has a sign should not be confused with absolute value of an error which is the modulus of an error.

4.11 *Relative Error* — The absolute error of measurement divided by true (conventional) value of the measurand.

4.12 *Random Error* — A component of the error of measurement which, in the course of a number of measurements of the same measurand, varies in an unpredictable way.

Note — It is not possible to correct the random error.

4.13 *Systematic Error* — A component of the error of measurement which, in the course of a number of measurements of the same measurand, remains constant or varies in predictable way.

Note — Systematic errors and their causes may be known or unknown.

4.14 *Correction* — The value which, added algebraically to the uncorrected result of a measurement, compensates for an assumed systematic error.

Note 1 — The correction is equal to the assumed systematic error, but is of opposite sign.

Note 2 — Since the systematic error cannot be known exactly, the correction is subject to uncertainty.

4.15 *Correction Factor* — The numerical factor by which the uncorrected result of a measurement is multiplied to compensate for an assumed systematic error.

Note — Since the systematic error cannot be known exactly, the correction factor is subject to uncertainty.

5. Measuring Instruments

5.1 *Measuring Instrument* — A device intended to make a measurement, alone or in conjunction with other equipment.

5.2 *Material Measure* — A device intended to reproduce or supply, in a permanent manner during its use, one or more known values of a given quantity.

Note — The quantity concerned may be called the supplied quantity.

Example: Length standard, of one or more values with or without scale.

5.3 *Measuring Transducer* — A measuring device which provides an output quantity having a given relationship to the input quantity.

Example: Probe used in electronic dimensional measurement.

5.4 *Measuring Chain* — A series of elements of a measuring instrument or system which constitutes the path of measurement signal from the input to the output.

Example: Surface finish measuring instrument comprising a stylus, meter, printer, etc.

5.5 *Measuring System* — A complete set of measuring instruments and other equipment assembled to carry out a specified measurement task.

Note — The term 'measuring installation' is reserved for measuring apparatus, usually of the larger kind, which is permanently installed.

Examples:

   a) Apparatus for calibration of slip gauge blocks,

   b) Measuring system for thread gauge calibration, and

   c) Surface plate calibration by spirit level/or auto-collimeter.

5.6 *Indicated Instrument* — A measuring instrument which displays the values of a measurand or a related value.

Examples:

   a) Micrometer, and

   b) Vernier.

5.7 *Recording Instrument* — A measuring instrument which provides a record (permanent or semi-permanent) of the value of a measurand or a related value.

Note 1 — The record may be analogue (continuous or discontinuous line) or digital.

Note 2 — Values of more than one quantity may be recorded simultaneously.

Note 3 — A recording measuring instrument may also incorporate an indicating device.

Example: Surface texture/roundness recorded on graph paper or on digital display.

5.8 *Totalizing Instrument* — A measuring instrument which determines the value of a measurand by summation of partial values of the measurand obtained simultaneously or consecutively from one or more sources.

5.9 *Integrating Instrument* — A measuring instrument which determines the value of a measurand by integrating a quantity with respect to another quantity.

Example: Surface finish measuring instrument.

5.10 *Analogue Measuring Instrument* — A measuring instrument in which the output or display is a continuous function of the value of the measurand.

Note — This term relates to the form of presentation of output or display, not to the principle of operation of the instrument.

Example: Dial indicator.

5.11 *Digital Measuring Instrument* — A measuring instrument which provides a digitalized output and/or display.

Note — This term relates to the form of presentation of output or display, not to the principle of operation of the instrument.

Example: Digital micrometer.

5.12 *Indicating Device* — For a measuring instrument, the set of components which displays the value of a measurand or a related value.

Note 1 — The term may include the indicating means or setting device of a material measure.

Note 2 — An analogue indicating device provides an analogue indication; a digital indicating device provides a digital indication.

Note 3 — A form of presentation of the indications either by means of a digital indication in which the least significant digit moves continuously thus permitting interpolation, or by means of a digital indication supplemented by a scale and index, is called a semi-digital indication.

Note 4 — The term 'read out device' is used as a general descriptor of the means whereby the response of a measuring instrument is made available.

5.13 *Recording Device* — For a recording instrument, the set of components which record the value of a measurand or a related value.

5.14 *Recording Medium* — A strip, disc, sheet or other structure on which is recorded the value of a measurand or a related value.

Note 1 — A recording medium bearing pre-printed co-ordinate lines is generally called a recording chart.

Note 2 — An electronic or magnetic recording medium may be called a memory.

5.15 *Sensor* — The element of a measuring instrument or measuring chain to which a measurand is directly applied.

Examples:

    a) Stylus of a lever type dial indicator, and

    b) Float of a level measuring instrument.

5.16 *Detector* — A device or substance which indicates the presence of a particular quantity without necessarily providing its value.

Note — In some cases, an indication may be produced only when the value of the quantity reaches a given threshold.

Example: LED display indicator.

5.17 *Scale Mark* — A line or other mark on an indicating device corresponding to one or more defined values of a measurand.

Note 1 — For digital and semi-digital indications, the numbers themselves are equivalent to scale marks.

Note 2 — The term 'gauge mark' is often used in cases where only one or a few marks are involved.

5.18 *Index* — The fixed or movable part of an indicating device whose position with reference to the scale marks enables an indicated value to be determined.

Examples:
    a) Pointer,
    b) Luminous spot,
    c) Liquid surface, and
    d) Recording pen.

5.19 *Scale* — An ordered set of scale marks, together with any associated numbering, forming a part of an indicating device.

5.20 *Scale Length* — For a given scale, the length of the line between the first and the last scale marks and passing through the centres of all the shortest scale marks.

> Note 1 — The line may be real or imaginary, curved or straight.

> Note 2 — Scale length is expressed in units of length regardless of the units of the measurand or the units marked on the scale.

5.21 *Scale Range* — For a given scale, the range of scale values between the extreme scale marks.

> Note — The scale range is expressed in the units marked on the scale, regardless of the units of the measurand, and is normally stated in terms of its lower and upper limits, for example, Vernier 0-300 mm.

5.22 *Scale Division* — The part of a scale between any two successive scale marks.

5.23 *Scale Spacing* — The distance between any two successive scale marks, measured along the same line as the scale length.

> Note — Scale spacing is expressed in units of length, regardless of the units, of the measurand or the units marked on the scale.

5.24 *Scale Interval* — The difference between the scale values corresponding to two successive scale marks.

> Note — Scale interval is expressed in the units marked on the scale, regardless of the units of the measurand.

5.25 *Linear Scale* — A scale in which each scale spacing is related to the corresponding scale interval by a coefficient of proportionality which is constant throughout the scale.

> Note — A linear scale having constant scale intervals is called a regular scale.

5.26 *Non-Linear Scale* — A scale in which each scale spacing is related to the corresponding scale interval by a coefficient of proportionality which is not constant throughout the scale.

> Note — Some non-linear scales are given special names, such as logarithmic scale square-law scale.

5.27 *Suppressed-Zero Scale* — A scale whose scale range does not include the scale value corresponding to zero value of the measurand.

> *Example*: Micrometer 50-75 mm.

5.28 *Expanded Scale* — A scale in which part of the scale range occupies a disproportionately large part of the scale length.

5.29 *Dial* — That part of an indicating device, fixed or moving, which carries the scale or scales.

> Note — In some indicating devices, the dial takes the form of drums or discs bearing numbers and moving relative to a fixed index or window.

5.30 *Scale Numbering* — The set of numbers, marked on the scale which either corresponds to the values of the measurand defined by the scale marks or merely indicate the numerical order of the scale marks.

5.31 *Zero of a Measuring Instrument* — The direct indication of a measuring instrument when the instrument is in use with zero value of the measurand, any auxiliary power supply required to operate the instrument being switched on.

> Note 1 — This term is commonly called electrical zero in the case of a measuring instrument having an electrical auxiliary power supply.

> Note 2 — The term 'mechanical zero' is often used when the instrument is not in use and any auxiliary power supply is switched off.

> Note 3 — The mechanical zero may possibly not coincide with the electrical zero; in some types of instruments, the mechanical zero may be indeterminate.

5.32 *Setting (of a Measuring Instrument)* — The operation of fixing the positions of the gauge marks or scale marks of a measuring instrument (in some cases of certain principal marks only), in relation to the corresponding values of the measurand.

5.33 *Adjustment* — The operation intended to bring a measuring instrument into a state of performance and freedom from bias suitable for its use.

5.34 *User Adjustment* — The operation intended to bring a measuring instrument into a state of performance and freedom from bias suitable for its use, employing only the means at the disposal of the user.

6. Characteristics of Measuring Instrument

6.1 *Nominal Range* — For each scale range, the set of values of the measurand for which a measuring instrument gives values within that scale range at a particular setting of its controls.

Note — The nominal range is expressed in units of the measurand, regardless of the units marked on the scale, and is normally stated in terms of its lower and upper limits, for example micrometer 25-50 mm. Where the lower limit is zero, the nominal range is commonly stated solely in terms of its upper limit, for example a nominal range of micrometer 0-25 mm is expressed as 25 mm.

6.2 *Span* — The modulus of difference between the two limits of a nominal range of a measuring instrument.

Example: Dial indicator with − 50μ to + 50μ span 100μ.

6.3 *Nominal Value* — A value used to designate a characteristic of a device or to give a guide to its intended use.

Note — The nominal value may be rounded value of the characteristic concerned and is often an approximate value of the quality realized by a standard.

Examples:

a) Size of a limit gauge 20 mm, and

b) Size of a ring gauge 25 mm.

6.4 *Specified Measuring Range/Specified Working Range* — The set of values of a measurand for which the error of a measuring instrument is intended to lie within specified limits.

Note — The upper and lower limits of the specified measuring range are sometimes called the maximum capacity and minimum capacity respectively.

6.5 *Rated Operating Conditions* — Conditions of use giving the ranges of the measurand and of the influence quantities, and other important requirements, for which the metrological characteristics of a measuring instrument are intended to lie within specified limits.

Note — The rated operating conditions generally specify rated values of the measurand and of the influence quantities.

6.6 *Limiting Conditions* — The extreme conditions which a measuring instrument can withstand without damage and without degradation of its metrological characteristics when it is subsequently operated under its rated operating conditions.

Note 1 — The limiting conditions for storage, transport and operation may be different.

Note 2 — The limiting conditions generally specify limiting values of the measurand and of the influence quantities.

6.7 *Reference Conditions* — Conditions of use for a measuring instrument prescribed for performance testing, or to ensure valid intercomparison of results of measurements.

Note — The reference conditions generally specify reference values or reference ranges for the influence quantities effecting the measuring instrument.

6.8 *Instrument Constant* — The coefficient by which a direct indication must be multiplied to obtain the indication of a measuring instrument.

Note 1 — A measuring instrument, in which the direct indication is equal to the value of the measurand, has an instrument constant of 1.

Note 2 — Multi-range measuring instruments with a single scale have several instrument constants which correspond, for example, to different positions of a selector mechanism.

Note 3 — For some measuring instruments, the transformation from direct indication to indication may be more complex than a simple multiplication by an instrument constant.

6.9 *Response Characteristic* — For defined conditions, the relationship between a stimulus and corresponding response.

Note 1 — The relationship may be based on theoretical or experimental considerations; it may be expressed in the form of an algebraic equation, a numerical table or a graph.

Note 2 — When the stimulus varies as a function of time, one form of response characteristic is the transfer function (the Laplace transform of the response divided by that of the stimulus).

6.28 *Bias Error* — The systematic component of the error of a measuring instrument.

6.29 *Freedom from Bias Error* — The ability of a measuring instrument to give indications free from bias error.

6.30 *Repeatability Error* — The random component of error of a measuring instrument.

6.31 *Repeatability* — The ability of a measuring instrument to give, under defined conditions of use, closely similar responses for repeated applications of the same stimulus.

> Note — The defined conditions of use are usually as follows:
>
> a) Repetition over a short period of time,
>
> b) Use at the same location under constant ambient conditions, and
>
> c) Reduction to a minimum of the variations due to the observer.

6.32 *Fiducial Error* — The error of a measuring instrument divided by a value specified for the instrument.

> Note — Specified value is generally called the fiducial value, and may be, for example, the span or the upper limit of the nominal range of the measuring instrument.

7. Measurement Standards

7.1 *Measurement Standard* — A material measure, measuring instrument or system intended to define, realize, conserve or reproduce a unit or one or more known values of a quantity in order to transmit them to other measuring instruments by comparison.

Example: Standard gauge block.

7.2 *Collective Standard* — A set of similar material measures or measuring instruments fulfilling, by their combined use, the role of a standard.

> Note 1 — A collective standard is usually intended to provide a single value of a quantity.

> Note 2 — The value provided by a collective standard is an appropriate mean or the values provided by the individual instruments.

7.3 *Group Standard* (*Series of Standards*) — A set of standards of specially chosen values which individually or in suitable combination reproduce a series of values of a quantity over a given range.

Example: Set of slip gauges.

7.4 *Primary Standard* — A standard which has the highest metrological qualities in a specific field.

> Note — The concept of primary standard is equally valid for base units and for derived units.

7.5 *Secondary Standard* — A standard whose value is fixed by comparison with a primary standard.

7.6 *International Standard* — A standard recognized by an international agreement to serve internationally as the basis for fixing the value of all other standards of the quantity concerned.

7.7 *National Standard* — A standard recognized by an official national decision as the basis for fixing the value, in a country, of all other standards of the quantity concerned.

> Note — The national standard in a country is often a primary standard.

7.8 *Reference Standard* — A standard, generally of the highest metrological quality available at a given location from which measurements made at that location are derived.

7.9 *Working Standard* — A standard, which usually calibrated against a reference standard, is used to calibrate or check material measures of measuring instruments.

7.10 *Transfer Standard* — A standard used as an intermediary to compare standards, material measures or measuring instruments.

> Note — When the comparison device is not strictly a standard, the term 'transfer device' should be used.

Example: Adjustable calipers used to intercompare end standards.

7.11 *Traceability* — The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.

7.12 *Calibration* — The set of operations which establish, under specified conditions, the relationship between values indicated by a measuring instrument or measuring system, or values represented by a material measure, and the corresponding known value of a measurand.

> **Note 1** — The result of a calibration permits the estimation of errors of indication of the measuring instrument, measuring system or material measure, or the assignment of values to marks on arbitary scales.

> **Note 2** — A calibration may also determine other metrological properties.

> **Note 3** — The result of a calibration may be recorded in a document, sometimes called a calibration certificate or a calibration report.

> **Note 4** — The result of a calibration is sometimes expressed as a calibration factor, or as a series of calibration factors in the form of a calibration curve.

7.13 *Conservation of a Measurement Standard* — All the operations necessary to preserve the metrological characteristics of measurement standards within appropriate limits.

> **Note** — The operations commonly include regular calibration, storage under good conditions and care in use.

7.14 *Reference Material* — A material or substance, one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

7.15 *Certified Reference Material* — A reference material, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body.

EXPLANATORY NOTE

This standard was first published in the year 1977 as 'Glossary of terms used in metrology' based on BS 5233 : 1975 'Glossary of terms used in metrology' issued by the British Standards Institution.

The first revision is based on ISO document 'International vocabulary of basic and general terms in metrology' published by the International Organization for Standardization (ISO).

It has been revised in relation to dimensional metrology and a few clauses have been added with the deletion of some of the clauses. A few suitable examples have also been included.

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